

before him, no European had ever entered. He was imprisoned as a spy by King Melelek, of Shoa, but was eventually released through the intercession of Marquis Antinori. He has brought back with him numerous valuable maps and a large collection of the fauna, flora, minerals, and other objects connected with the regions he explored.

LIEUT. WISSMANN is preparing to set out on a new expedition to the Upper Congo.

THE United States observing party at Point Barrow have returned to Alaska, *en route* for San Francisco.

THE French war steamer, which was sent out last year with the French scientific mission to Cape Horn, is daily expected with the party, who have spent their winter in this remote part of the world. These observations have been carried on in connection with the Polar observations as organised by the International Conference, and have been made from August, 1882, to August, 1883.

"THE Yearly Report of the Swiss Alpine Club" for 1882, the eighteenth volume of the series, contains many and various contributions towards a fuller knowledge of the Alps. Besides valuable letterpress we are treated to excellent panoramas after original drawings, coloured views, woodcuts, and cartographical sketches.

IN one of a collection of lectures published at Heidelberg, 1883, by the house of Carl Winter, A. von Lasaulx, the well-known geologist, draws an ingenious parallel between Ireland and Sicily, and attempts to explain the backward state of the inhabitants of these two islands and the disorders of which they have been the theatre by the nature of their geological strata, the formation of their coasts and their positions.

THE last number of the *Izvestia* of the Russian Geographical Society, contains, besides minutes of proceedings, two papers by Dr. Woeikof, on the diurnal period of the velocity of the wind in Russia, and on the distribution of heat in the oceans; a paper by Prof. Lenz, on the periodicity of auroras; the annual reports of the western and eastern Siberian branches of the Society; the end of M. Polyakoff's letters from Sakhalin, wherein he describes his journey on boat down the Tym River and on the eastern coast of Sakhalin; and several notes. We notice among these latter a list of forty-two places in Persia, Attak, and Akhal-Tekke, the positions of which were determined by Capt. Gladysheff.

THE EVOLUTIONARY POSITION¹

I HAVE been requested by the Subjects Committee of the Congress to place before you a brief statement of some of the advances which have recently been made in natural science, with a view to open a discussion upon their relations, real or supposed, to religious belief. The particular advances which, as I am given to understand, were especially in the minds of the Committee in proposing this question, are those which have resulted in the more or less general adoption by scientific men of the view of the sequence of events which have taken place, and are still taking place, in the universe, to which the term "evolution" is now commonly applied.

All that is embraced by this term, the various realms of nature in which its manifestations are traced, the various shades of meaning attached to it by different persons, would constitute far too large and complex a subject to be treated of in the time to which addresses to this meeting are wisely restricted. I will therefore select for special consideration the only point in the application of the theory upon which I can speak with any practical knowledge; one which is, however, in the eyes of many of very vital interest. It is the one, at all events, which at the present moment attracts most attention; the new ideas upon it being received with enthusiasm by some, and with distrust, if not with abhorrence, by others.

The doctrine of continuity, or of direct relation of an event to some preceding event according to a natural and orderly sequence is now generally recognised in the inorganic world; and although the modern expansion of this doctrine as applied to the living inhabitants of the earth appears to many so startling, and has met with so much opposition, it is, in a more restricted applica-

tion, a very old and widespread article of scientific as well as of popular faith.

Putting aside, as quite immaterial to the present discussion, the still controverted question of the evidences of the production of the lowest and most rudimentary forms of life from inorganic matter, it may be stated as certain that there is no rational and educated person, whatever his religious beliefs or philosophical views, who is not convinced that every individual animal or plant, sufficiently highly organised to deserve such distinctive appellation, now existing upon the world, has been produced from pre-existing parents by the operation of a series of processes of the order to which the term natural is commonly applied; processes also fundamentally the same throughout the whole range of living beings, however much modified in detail to suit the various manifestations under which those beings are presented to us. We feel absolutely certain, when we see a horse, a bird, a butterfly, or an oak tree, that each was derived from pre-existing parents more or less closely resembling itself. Though we have no direct evidence of the fact in each individual case, the knowledge derived from the combined observations of an overwhelming number of analogous cases is of such a positive character, that we should entirely refuse to credit any one who made the contrary assertion, and should feel satisfied that he had been deluded by some error of observation. We cannot, indeed, conceive of the sudden beginning of any such creatures, either from nothing, from inorganic matter, or even from other animals or plants totally unlike themselves.

To persons whose opportunities of observation of animal and plant life are limited to a comparatively few kinds, existing under comparatively similar circumstances, and which observations moreover only extend over a comparatively limited period of time, it appears that in each kind of animal or plant, such as those just mentioned, individuals of various succeeding generations present a very close resemblance to each other. That they often vary a little cannot escape careful observation, but the deviations from the common characters of the kind to be noticed by persons whose range of vision is thus limited are not striking, and usually appear not to pass beyond certain bounds. Hence arose the common idea, natural enough under such circumstances, but which gradually developed itself, not only into a scientific hypothesis, but even, it would appear, almost into an article of religious belief, that the different kinds or "species," as they are technically called, of animals and plants, had each its separate origin, its fixed limits of variation, and could not under any circumstances become modified or changed into any other form.

This idea became deeply rooted in the human mind, in consequence of the very long period during which it prevailed, the horizon of observation having remained practically stationary from the time man first began to observe and record the phenomena of nature until little more than a century ago, when commenced that sudden expansion of knowledge of the facts of the animal and vegetable world which has been steadily widening ever since. Now it is important to observe that it is strictly *pari passu* with the growth of knowledge of the facts, that the theoretical views of nature have changed, and the older hypothesis of species to which I have referred has gradually given way to a new and different one.

The expansion of the special branches of knowledge affecting our views upon this subject has taken place in many different directions, of which I can here only indicate the most striking.

1. The discovery of enormous numbers of forms of life, the existence of which was entirely unknown a hundred years ago. The increase of knowledge in this respect is something inconceivable to those who have not followed its progress. Not only has the number of well defined species known multiplied prodigiously, but infinite series of gradations between what were formerly supposed to be distinct species are being constantly brought to light. The difficulty of giving any satisfactory definition of what is meant by the term "species" is increasingly felt day by day by practical zoologists, as evidenced by the introduction of such terms as "sub-species," "permanent local variety," &c., into general use, and especially by the wide differences of opinion as to the number or limits of the species included in any given group of animals or plants among naturalists who have made such group their special study.

2. Vast increase in the knowledge of the intimate structure of organic bodies, both as revealed by ordinary dissection and by microscopic examination, a method of investigation only brought to perfection in very recent years. By the knowledge thus acquired has been demonstrated the unity of plan pervading, under diverse modifications, the different members of each

¹ The following address by Prof. Flower, F.R.S., President of the Zoological Society, was given at the recent Church Congress as introductory to a discussion on "Recent Advances in Natural Science in their Relation to the Christian Faith." The address has been revised by the author.

natural group of organisms at one time attributed to "conformity to type," a so-called explanation which explained nothing, but for which a *vera causa* may be found in descent from a common ancestor. Wonderful gradations in the perfection to which different structures have attained in the progress of their adaptation to their respective purposes have also been shown, and of still greater importance and interest, the numerous cases of apparently useless or rudimentary organs in both animals and plants, which were absolutely unaccounted for under the older hypothesis.

3. The comparatively new study of the geographical distribution of living things, which has only become possible since the prosecution of the systematic and scientific explorations of the earth's surface which have distinguished the present century. The results of this branch of inquiry alone have been sufficient to convince many naturalists of the unsoundness of the old view of the distinct origin of species, whether created each in the region of the globe to which it is now confined, or, as many still imagine, all in one spot, from which they have spread themselves unchanged in form, colour, or other essential attributes to their present abodes, however diverse in climate and other environments or conditions of existence.

4. Lastly, though most important of all, must be mentioned the entirely new science of palæontology, opening up worlds of organic life before unknown, also showing infinite gradations of structure, but mainly important as increasing our horizon of observation to an extent not previously dreamt of in the direction of time. Powers of observation formerly limited to the brief space of a few generations are now extended over ages, which the concurrent testimony of various branches of knowledge, of astronomy, cosmogony, and geology, show are immeasurable compared with any periods of which we hitherto had cognisance. We are enabled to trace, and every year, as discovery succeeds discovery, with increasing distinctness, numerous cases of sequences of modification running through groups of animals in successive periods of time, such as the gradual progress in the development and perfection of the antlers of deer, from their entire absence in the earliest known representatives of the type, through the simple conical or bifurcated form, increasing in complexity as time advanced to the magnificent many-branched appendages which adorn the heads of some species of recent stags; such also as the progressive modifications, so often described, beginning in the short-necked, heavy-limbed, many-toed tapir-like animal of the Eocene period, and ending in the graceful, long-necked, light-limbed, single-toed horse of our own age, and numerous others which time will not allow me even to mention.

It would be impossible here to trace the history of the effect of this enormous influx of knowledge upon the doctrine of the separate origin and fixed characters of species; to narrate the scattered efforts of philosophical minds, discontented with the former views, but not yet clearly seeing the light; to describe the slow and struggling growth of the new views, amid difficulties arising from imperfections of knowledge, and the opposition of prejudice, or to apportion to each of those who by their labours have contributed to the final result his exact share in bringing it about. How much, for instance, is due to the work and the writings of our illustrious countryman Darwin? and how much to those who have preceded or followed him? All this forms an episode in the history of the progress of human knowledge which has been abundantly chronicled elsewhere.

The result may, however, be briefly stated to be that the opinion now almost, if not quite, universal among skilled and thoughtful naturalists of all countries, and whatever their beliefs upon other subjects, is that the various forms of life which we see around us, and the existence of which we know from their fossil remains, are the product, not of independent creations, but of descent, with gradual modification from pre-existing forms. In short, the law of the natural descent of individuals, of varieties, races, or breeds (which, being within the limits of the previous powers of observation, was already universally admitted) has been extended to the still greater modifications constituting what we call species, and consequently to the higher groups called genera, families, and orders. The barrier fancied to exist between so-called varieties and so-called species has broken down.

Any one commencing the study of the subject at the present time without prejudice, and carefully investigating the evidence upon which to form his conclusions, bearing in mind that he must look for his proofs, not so much in direct experiments or absolute demonstrations, which from the nature of the case are impossible, but in the convergence of the indications furnished

by the interpretations of multitudinous facts of most diverse kinds, must find it extremely difficult to place himself in the position of those who held the older view, so much more reasonable, so much more in accordance with all that we know of the general phenomena of nature, does this new one seem. In fact the *onus probandi* now appears entirely to lie with those who make the assertion that species have been separately created. Where, it may be asked, is the shadow of a scientific proof that the first individual of any species has come into being without pre-existing parents? Has any competent observer at any time witnessed such an occurrence? The apparent advent of a new species in geological history, a common event enough, has certainly been cited as such. As well might the presence of a horse in a field, with no sign of other animals of the same kind near it, be quoted as evidence of the fallacy of the common view of the descent of individuals. Ordinary observation tells us of the numerous causes which may have isolated that horse from its parents and kindred. Geologists know equally well how slight the chances of more than a stray individual or fragment of an individual here and there being first preserved and afterwards discovered to give any indication of the existence of the race. Those who object to the new view complain sometimes of the frequency with which its advocates take refuge, as they call it, in the "imperfection of the geological record." I think, on the contrary, the difficulty is always to allow sufficiently for this imperfection. When we contrast the present knowledge of palæontology with what it was fifty or even ten years ago; when we see by what mere accident, as it were, a railway driven through a new country, a quarry worked for commercial purposes, a city newly fortified, all the most important discoveries of extinct animals have been made, we must be convinced that all arguments drawn from the absence of the required links are utterly valueless. The study of palæontology is as yet in its merest infancy; the wonder is that it has already furnished so much, not so little, corroboration of the doctrine of transmutation of species.

Direct proof is, then, equally absent from both theories. For the old view it may be said that it has been held for a very long time by persons whose knowledge of the facts of nature which bear upon it was extremely limited. On the other hand, the new view is continually receiving more support as that knowledge increases, and furnishes a key to a vast number of otherwise inexplicable facts in every branch of natural history, in geological and geographical distribution, in the habits of animals, in their development and growth, and especially in their structure. Allow me to take one instance from the last named—the anatomy of the whale. How is it possible, upon any other supposition than that it is the descendant of some land animal, with completely developed limbs and teeth, which has become gradually modified to suit an aquatic mode of existence, to explain the presence of the numerous rudimentary, and to their present possessors absolutely useless, structures found in its body. Amongst others, a complete set of teeth, existing only in embryonic life, entirely disappearing even before birth, and rudimentary hind legs, with their various bones, joints, and muscles, of which no trace is seen externally. It may be asserted that the whale was originally created so, as it was asserted, and long maintained, that fossil shells and bones were originally created as such in the rocks in which they are found. It took more than two centuries of continuous and most acrimonious discussion to convince the world, especially the theological world, that these were the actual remains of animals which had once lived in a former period of the earth's history. Their evidence is now, however, universally admitted as supplying knowledge of the changed conditions of the surface of the earth, and with equal clearness do these rudimentary organs, hidden in the secret recesses of the whale's body, furnish, to those who inquire, indications that the animal has passed through phases of existence unlike those in which we now see it.

I do not for a moment assert that the new view explains everything that we students of nature are longing to know, or that we do not everywhere meet with obscure problems and perplexing difficulties, facts that we cannot account for, and breaks in the chain of evidence. As to the details and mode of operation of the secondary laws by which variation and modification have been brought about, we are far from being in accord. Happy for us that it is so, or our work would be at an end. I only maintain that the transmutation view removes more difficulties, requires fewer assumptions, and presents so much more consistency with observed facts than that which it seeks to supersede, and is, therefore, so generally accepted, that there is no

more probability of its being abandoned, and the old doctrine of the fixity of species revived, than that we should revert to the old astronomical theories which placed the earth in the centre of the universe, and limited the date of its creation to six ordinary days.

The question of the fixity or the transmutation of species is a purely scientific one, only to be discussed and decided on scientific grounds. To the naturalist, it is clearly one of extreme importance, as it gives him for the first time a key to the interpretation of the phenomena with which he has to deal. It may seem to many that a question like this is entirely beside the business of a Church Congress, as it is one with which only those expert in the ways of scientific investigation, and deeply imbued with knowledge of scientific facts, could be called upon to deal. This would certainly have been my view, if it had not been that some who, from their capacities and education, should have been onlookers in such a controversy, awaiting the issues of the conflict while the lists are being fought out by the trained knights, have rushed into the fray, and by their unskilful interposition have only confused the issues, casting about dust instead of light. In the hope of clearing away some of this dust the present discussion has been decided upon.

It is self-evident that a solid advance of any branch of knowledge must, in some way or other, and to a greater or less degree, influence many others, even those not directly connected with it, and therefore the rapid simultaneous strides of so many branches of knowledge as may be embraced under the term of "Recent Advances in Natural Science," will be very likely to have some bearing upon theological beliefs. Whether in the direction of expanding, improving, purifying, elevating, or in the direction of contracting, hardening, or destroying, depends not upon those engaged in contributing to the advance of science, but upon those whose special duty it is to show the bearing of these advances upon hitherto received theological dogmas. The scientific questions themselves may well be left to experts. If the new doctrines are not true, there are plenty of keen critics among men of science ready to sift the sound from the unsound. Error in scientific subjects has its day, but it is certain not long to survive the ordeal, yearly increasing in severity, to which it is subjected by those devoted to its cultivation. On the other hand, the advances of truth, though they may be retarded, will never be stopped by the opposition of those who are incompetent by the nature of their education to deal with the evidence on which it rests. There is no position so fraught with danger to religion as that which binds it up essentially with this or that scientific doctrine, with which it must either stand or fall. The history of the reception of the greatest discoveries in astronomy and geology, the passionate clinging to the exploded pseudo-scientific views on those subjects supposed to be bound up with religious faith, the fierce denunciations of the advocates of the then new, but now universally accepted, ideas, are well-worn subjects, and would not be alluded to but for the repetition, almost literal repetition in some cases, of that reception which has been accorded to the new views of biology.

Ought not the history of those discoveries and the controversies to which they gave rise to be both a warning and an encouragement? Those who hoped and those who feared that faith would be destroyed by them have been equally mistaken; and is not probable that the same result will follow the great biological discoveries and controversies of the present day?

In stating thus briefly what is the issue of these discoveries, as generally understood and accepted by men of science, I have done all that I promised, and must leave in far more competent hands the part of the subject especially appropriate for discussion at this meeting. I may, however, perhaps be allowed to put a few plain and simple considerations before you, which may have some bearing upon the subject, and which have no pretensions to novelty, though, being often lost sight of, their repetition may do no harm.

I said at the commencement of this paper that it has long been admitted by all educated persons, whatever their religious faith may be, that that very universal but still most wonderful process, the commencement and gradual development of a new individual of whatever living form, whether plant, animal, or man, takes place according to definite and regularly acting laws, without miraculous interposition. Further than this, I believe that every one will admit that the production of the various races or breeds of domestic animals is brought about by similar means. We do not think it necessary to call in any special intervention of creative power to produce a short-horned race of cattle, or to account for the difference between a bulldog and a

greyhound, a Dorking and a Cochin China fowl. The gradual modifications by which these races were produced, having taken place under our own eyes as it were, we are satisfied that they are the consequence of what we call natural laws, modified and directed in these particular cases by man's agency. We have even gone further, having long admitted, without the slightest fear of producing a collision with religious faith, that variation has taken place among animals in a wild state, producing local races of more or less stable and permanent character, and brought about by the influence of food, climate, and other surrounding circumstances.

The evidences of the Divine government of the world, and of the Christian faith, have been sufficient for us, notwithstanding our knowledge that the individual was created according to law, and that the race or variety was also created according to law. In what way then can they be affected by the knowledge that the somewhat greater modifications, which we call species, were also created according to law? The difficulties, which to some minds seem insuperable, remain exactly as they were; the proofs, which to others are so convincing, are entirely unaffected by this widening of scientific knowledge.

Even to what is to many the supreme difficulty of all, the origin of man, the same considerations are applicable. Believe everything you will about man in his highest intellectual and moral development, about the nature, origin, existence, and destiny of the human soul—you have long been able to reconcile all this with the knowledge of his individual material origin according to law, in no whit different in principle from that of the beasts of the field, passing through all the phases they go through, and existing long before possessing, except potentially, any of the special attributes of humanity. At what exact period and by what means the great transformation takes place no one can tell. If the most Godlike of men have passed through the stages which physiologists recognise in human development without prejudice to the noblest, highest, most divine part of their nature, why should not the race of mankind, as a whole, have had a similar origin, followed by similar progress and development, equally without prejudice to its present condition and future destiny? Can it be of real consequence at the present time, either to our faith or our practice, whether the first man had such an extremely lowly beginning as the dust of the earth, in the literal sense of the words, or whether he was formed through the intervention of various progressive stages of animal life?

The reign of order and law in the government of the world has been so far admitted that all these questions have really become questions of a little more or a little less order and law. Science may well be left to work out the details as it may. It has thrown some light, little enough at present, but ever increasing, and for which we should all be thankful, upon the processes or methods by which the world in which we dwell has been brought into its present condition. The wonder and mystery of creation remains as wonderful and mysterious as before. Of the origin of the whole, science tells us nothing. It is still as impossible as ever to conceive that such a world, governed by laws, the operations of which have led to such mighty results, and are attended by such future promise, could have originated without the intervention of some power external to itself. If the succession of small miracles, formerly supposed to regulate the operations of nature, no longer satisfies us, have we not substituted for them one of immeasurable greatness and grandeur?

A GREEN SUN IN INDIA

WE have received the following communications on this phenomenon. At the same time we may refer to a passage in one of Mr. Norman Lockyer's papers on "Physical Science for Artists," in which he speaks of the marked effects of aqueous vapour in the atmosphere on the character of the sun's light. He states that he asked Dr. Schuster to test his theory while in India. "Theory," he states, "had led me to expect that with the enormous thickness of air available there, absorption at the red end of the spectrum by aqueous vapour would be seen as well as the absorption at the blue, which is so common with us. Seeing the sun a vivid green through the steam of the little paddle-boat on Windermere first led me to inquire into the possibility of aqueous vapour following the same law as that which I think we may now accept in the cases of the vapours of metals. As in these experiments with vapours absorption of the red end alone was seen, as well as absorption at the blue end alone, the